CC Technical Documentation
RM-11 Series Transceivers

Troubleshooting - RF (Part 2)

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Synthesizer Troubleshooting

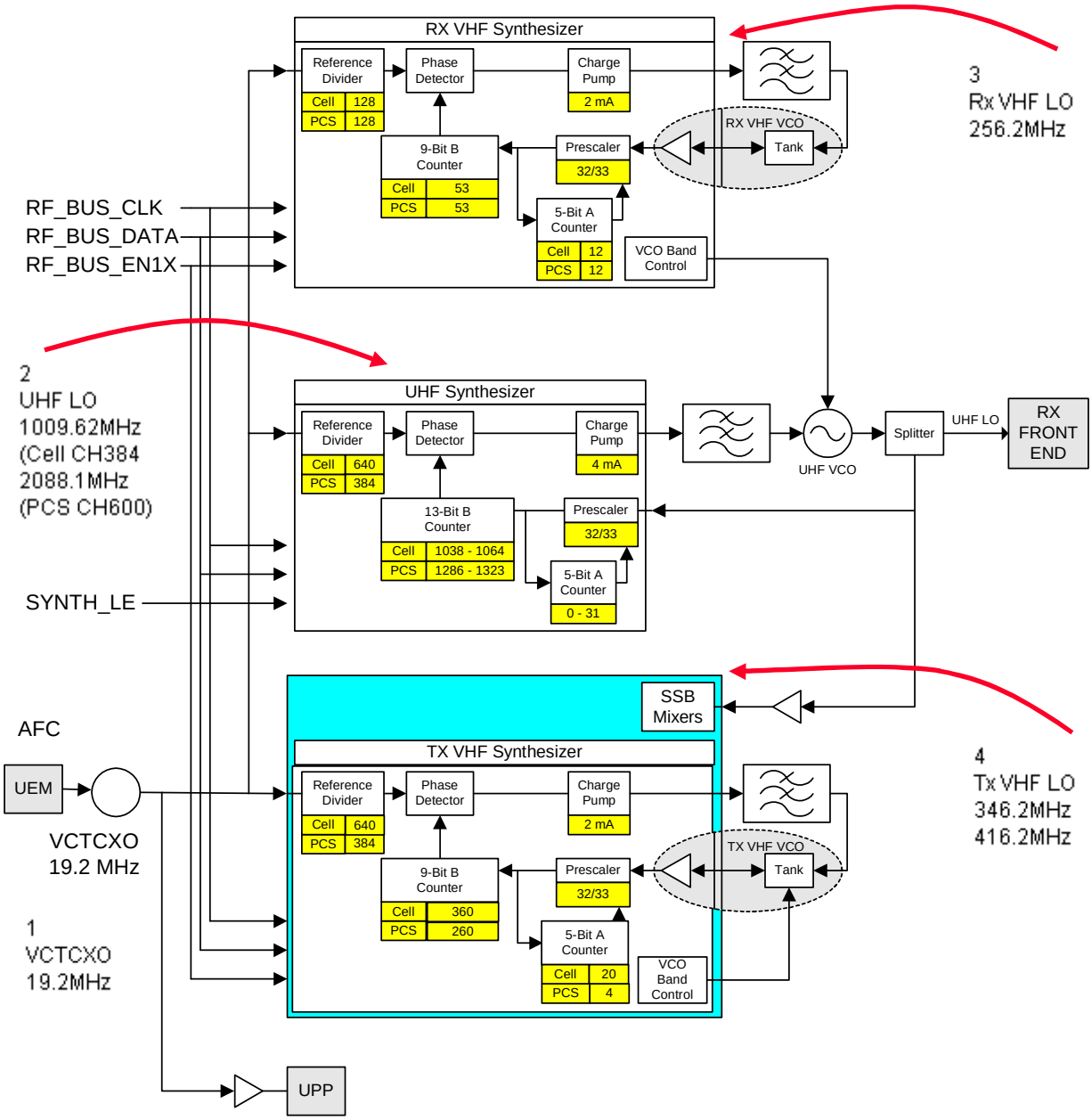

Figure 1: Synthesizer troubleshooting diagram

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Synthesizer Setup Using Phoenix

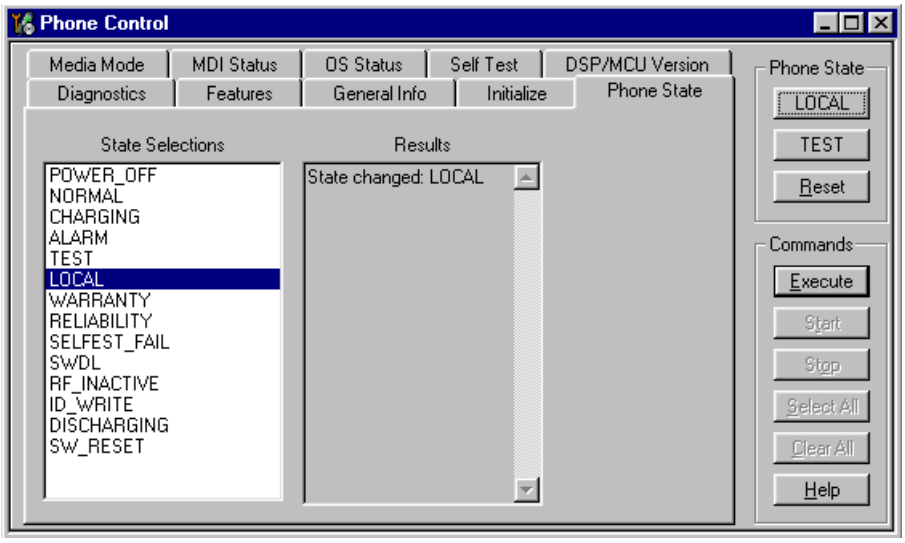

Figure 2: Phone Control dialog box

1. Click the **LOCAL** button on the **Phone Control** dialog box.
2. Use the following settings for the fields on the **RF Main Mode** dialog box:

   - UHF: Use RX/TX mode in PCS and Cell band. This allows for checking power to both RX and TX circuits. Typically, use channel 384 in Cell band and 600 in PCS band.
   - RX VHF: Use RX mode; one band is enough.
   - TX VHF: Use RX/TX mode in PCS and Cell band.

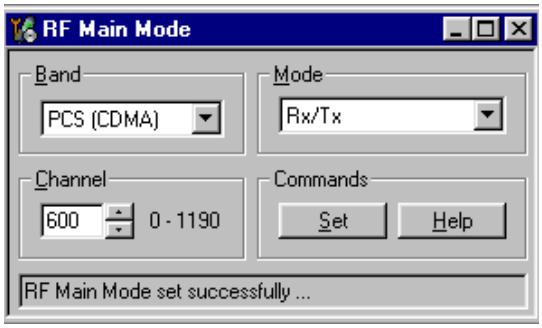

Figure 3: RF Main Mode dialog box

3. Click the **Set** button.

   Note: Make sure the "RF Main Mode set successfully..." message appears.

VCTCXO Troubleshooting

The VCTCXO frequency is 19.2MHz, which is the reference signal. Without 19.2MHz, the phone will not power up. This signal goes to Batman, Robin, UHF PLL, and also to the UPP via a buffer amplifier (D572).

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Check for the presence of the signal at the following points (use a high-impedance RF probe):

- CLK19M2_B, clock reference to Batman, should be +4.5dBm
- CLK19M2_R, clock reference to Robin, should be +4.5dBm
- CLK19M2_UPP, clock reference to UPP, should be +7.5dBm

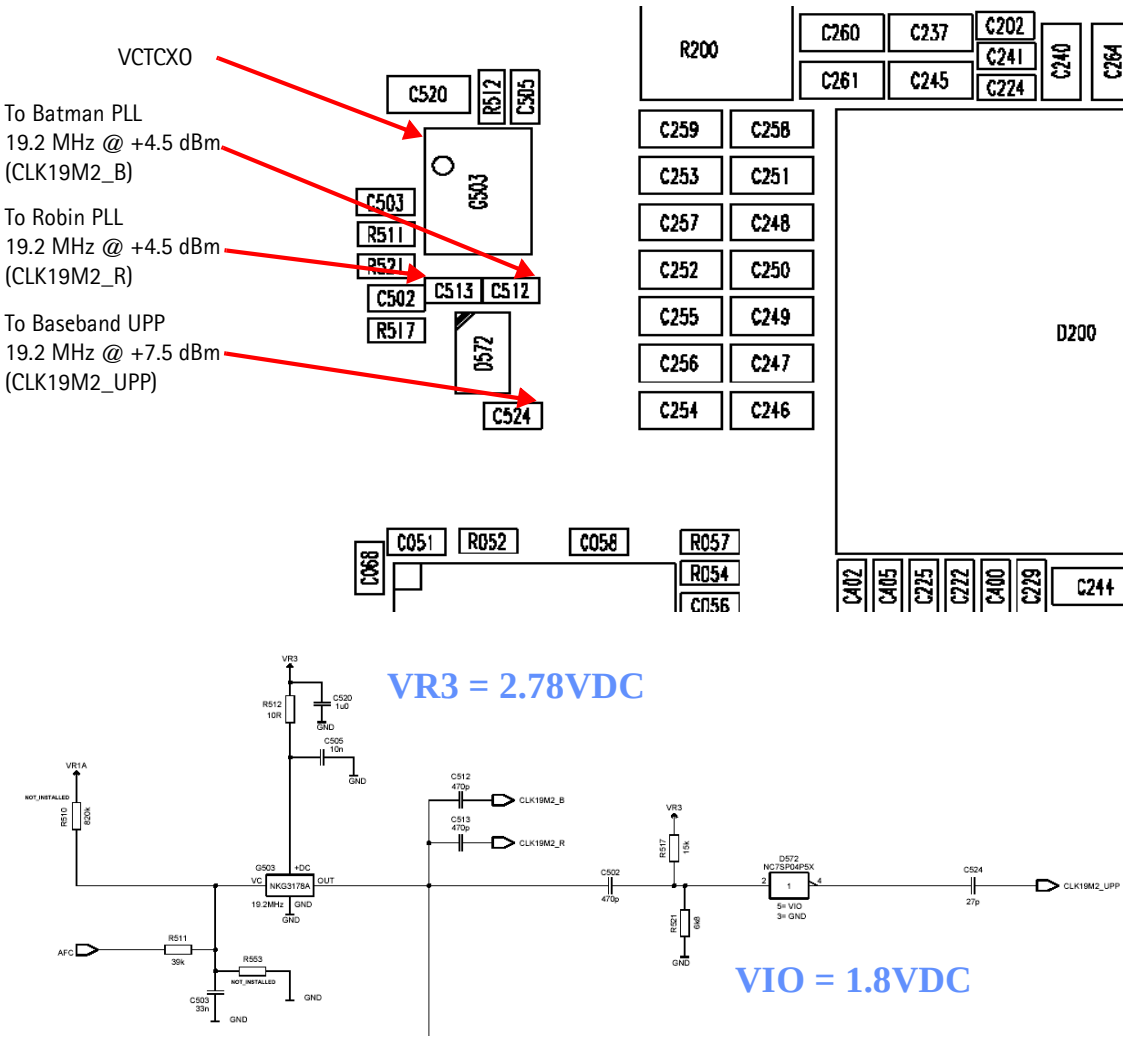

Figure 4: Presence of signal test points

If you do not see the VCTCXO signal at any of these points, check the voltages at the following supply lines:

- VR3, main supply line for VCTCXO circuitry, should be 2.78VDC
- VIO, supply line for buffer amplifier, should be 1.8VDC

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UHF Synthesizer Troubleshooting

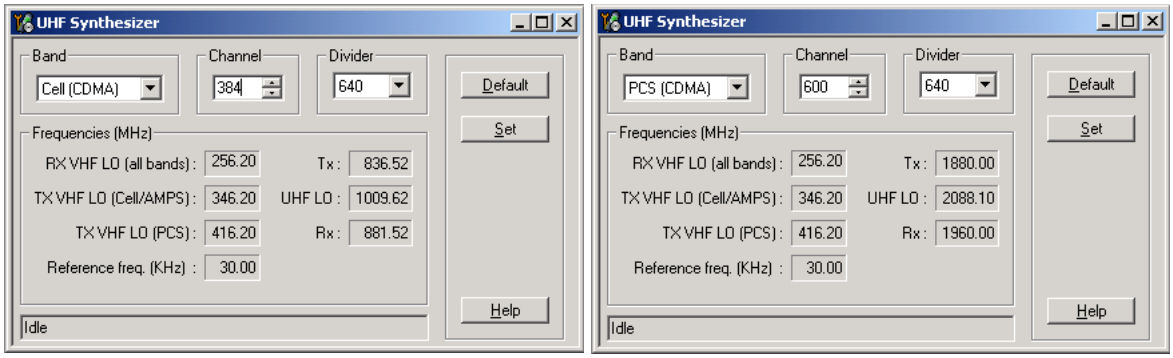

Figure 5: UHF Synthesizer dialog box for Cell (left) and PCS (right) bands

UHF LO frequency varies with channel and can be quickly calculated using the **UHF Synthesizer** dialog box on the RF menu. Check to see if the LO is actually locked. Set a channel and check the status of the UHF LO within a very narrow span of 100KHz. You should see the LO virtually immobile. Nominal UHF LO signal levels are measured with an RF probe (see the following figures). If you do not see the presence of any LOs, check DC voltages at the following locations:

- R513, VR1A, supply line for UHF PLL IC. Should be 4.76VDC
- R515, VR4, supply line for VCO IC. Should be 2.76VDC

UHF Synthesizer Schematic

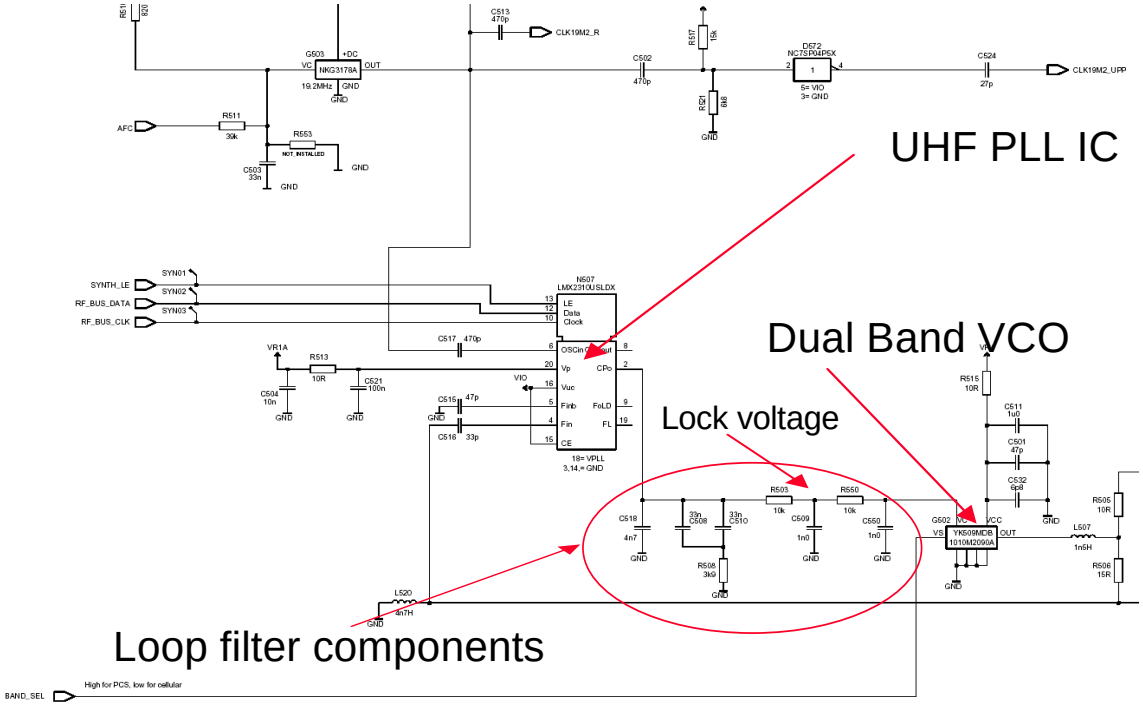

Figure 6: UHF synthesizer schematic

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UHF Synthesizer Layout

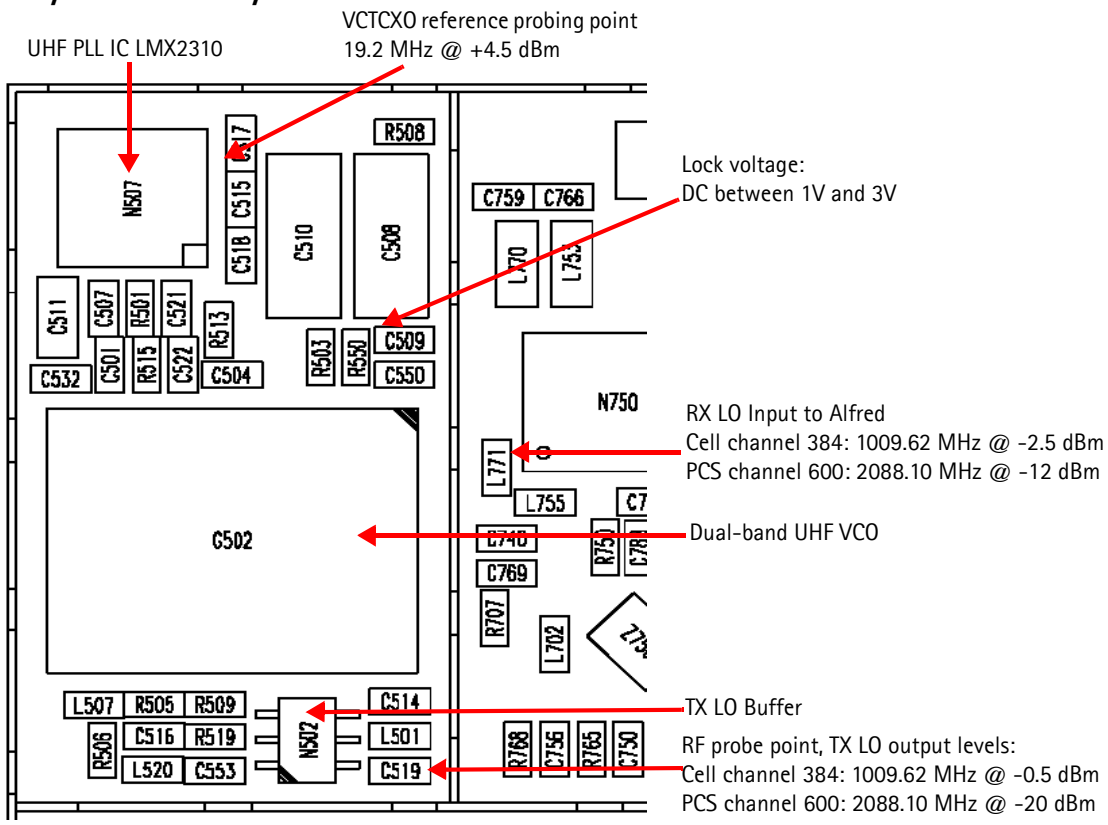

Figure 7: UHF synthesizer layout

UHF Frequency is Incorrect

Possible causes:

- Power supplies to PLL IC (N507) are missing or low
- Loop filter components missing or incorrectly installed
- 19.2MHz reference clock missing or low
- Programming is incorrect
- Component failure (VCO or PLL IC)

RX VHF (Batman LO) Schematic

- Operates at a fixed frequency of 256.2MHz. It is the second LO for down-conversion to I and Q for baseband processing. Refer to the frequency plan.
- Monitor probing point at C702 for Batman LO. A locked and stable 256.2MHz with an amplitude of ~= -2.5dBm should be observed on the spectrum analyzer.
- Monitor control voltage at C715. The control voltage at locked state should be between 1.2 and 1.7VDV for the proper operation of Batman LO.

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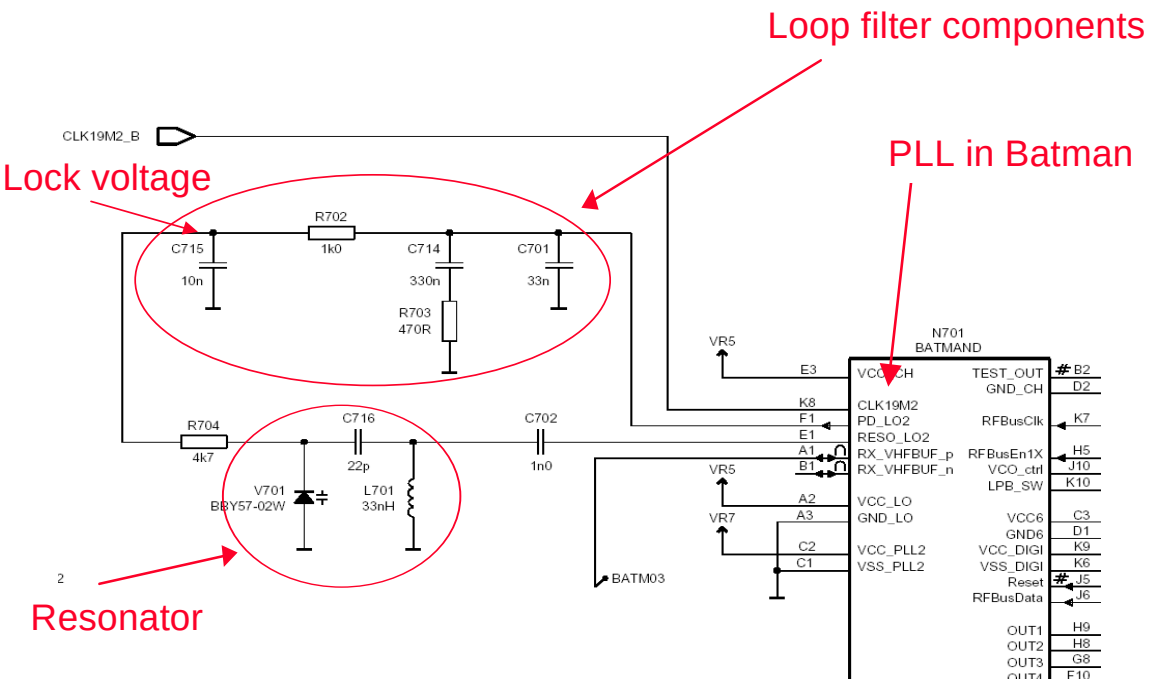

Figure 8: RX VHF (Batman LO) Schematic

RX VHF Layout

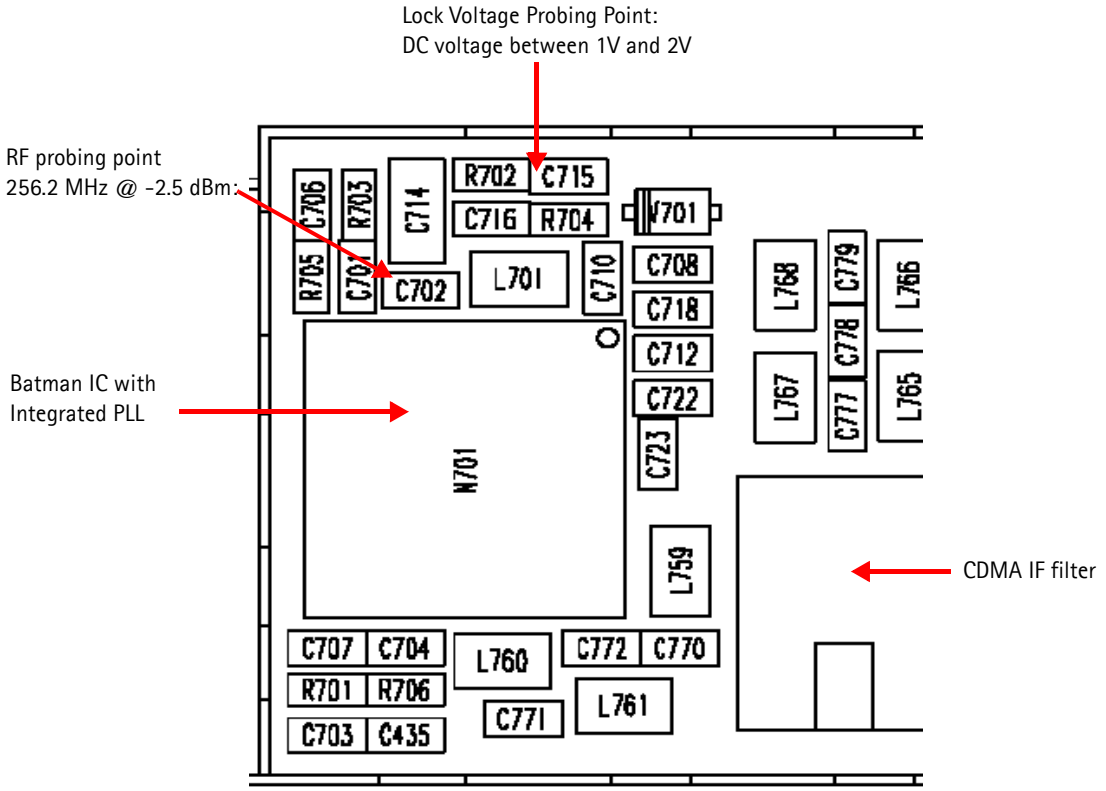

Figure 9: RX VHF layout

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Incorrect RX VHF Frequency

Possible causes:

- Power supplies to PLL portion of Batman IC (N701) missing or low (VR7)
- Loop filter or resonator components missing or incorrectly installed
- 19.2MHz reference clock missing or low (C512)
- Programming is incorrect
- Component failure (PLL IC)

TX VHF Schematic

There are two fixed LOs – 346.2MHz for Cell band and 416.2MHz for PCS band. This is the first LO for up-conversion. Refer to the frequency plan.

Monitor the probing point at C638 with a high-impedance RF probe for Robin LO. A sufficiently strong and stable signal should be observed on the spectrum analyzer.

Monitor control voltage at C632. At this control voltage, the Robin LO is locked (it should be between 1.2 and 1.8VDC).

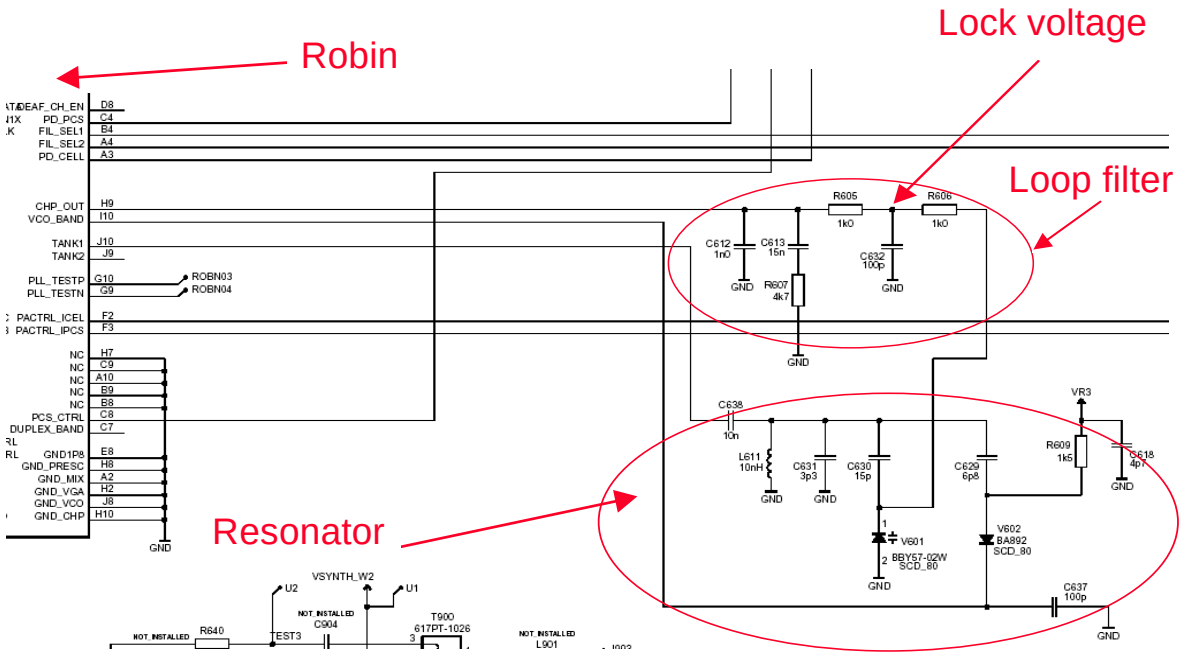

Figure 10: TX VHF Schematic

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TX VHF Layout

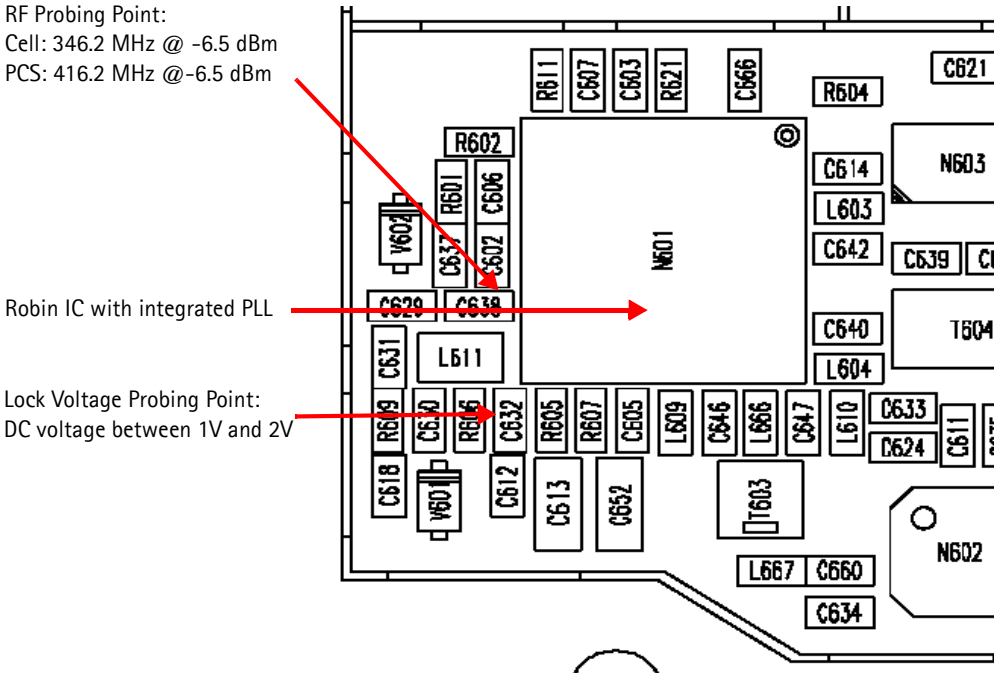

Figure 11: TX VHF Layout

Incorrect TX VHF Frequency

Possible causes:

- Power supplies to PLL portion of Robin IC (N601) missing or low (VR3)
- Loop filter or resonator components missing or incorrectly installed
- 19.2MHz reference clock missing or low
- Programming is incorrect
- Component failure (PLL IC)

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TX Troubleshooting

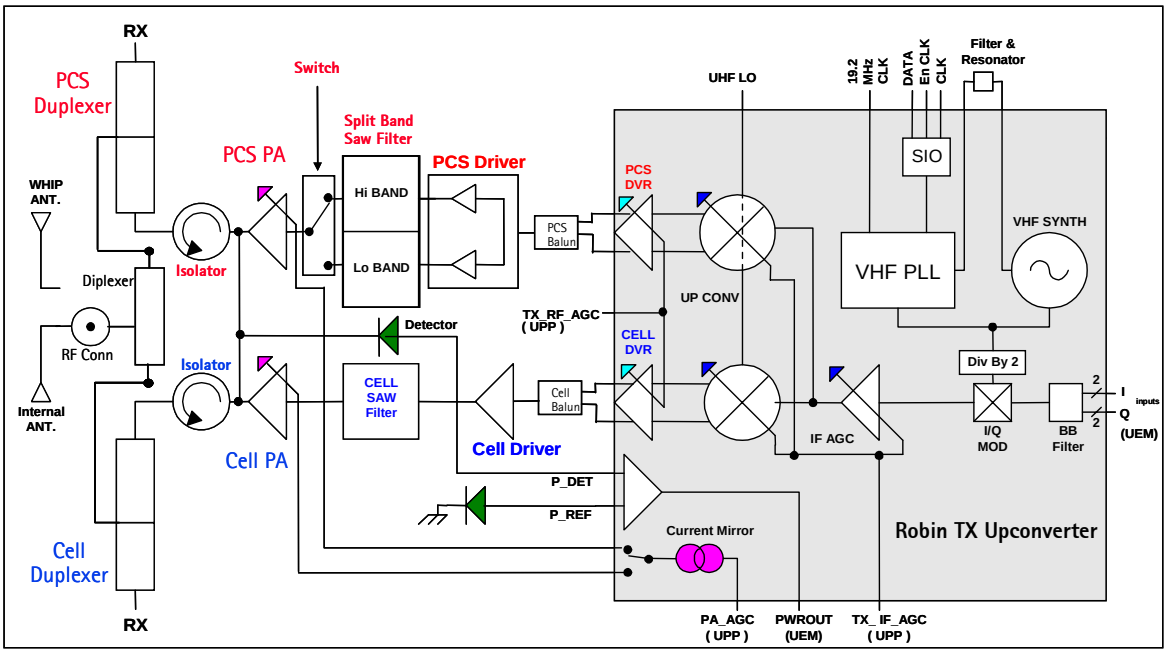

Figure 12: RM-11 TX system block diagram

Setup the phone in Local Mode with the appropriate band, channel, RHO on, and PDM settings. An Agilent call box 8960 is recommended to measure TX power at the RF connector. The numbers in Figure 13 and Figure 14 indicate the general RF signal flow and probing locations. More details are given in the following sections.

Transmitter Schematic 1

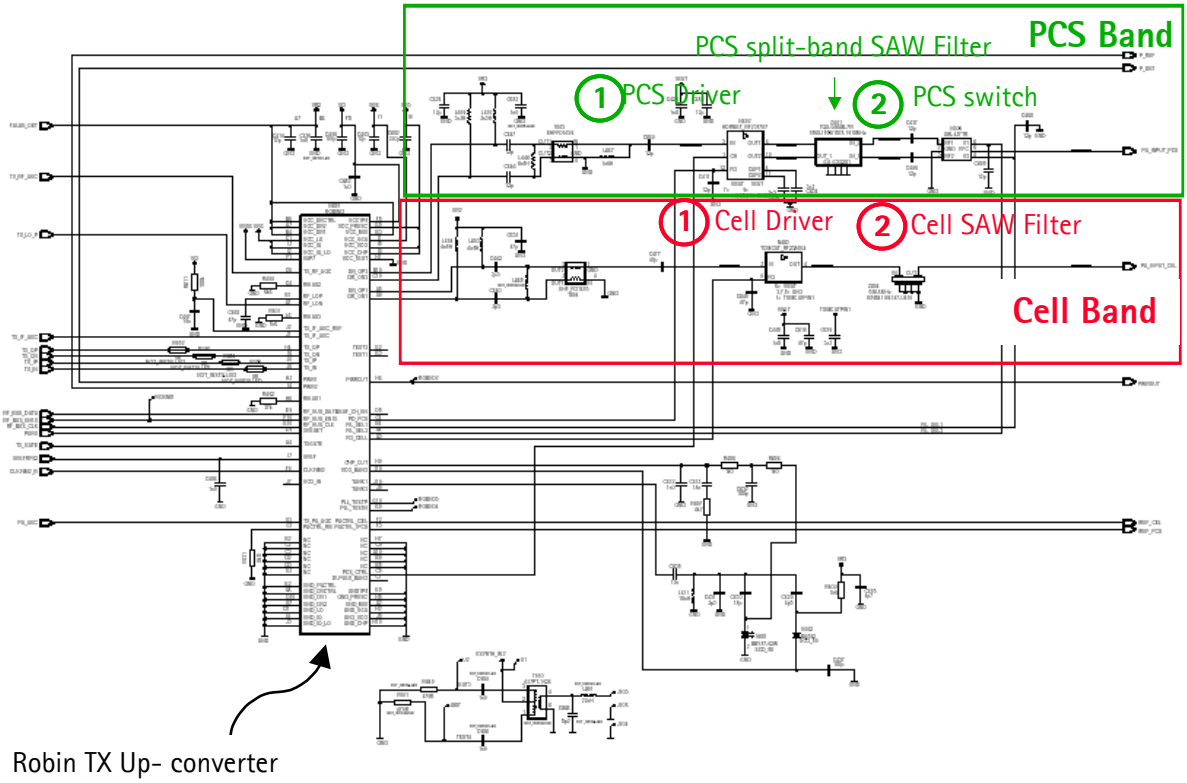

Figure 13: Transmitter Schematic 1

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Transmitter Schematic 2

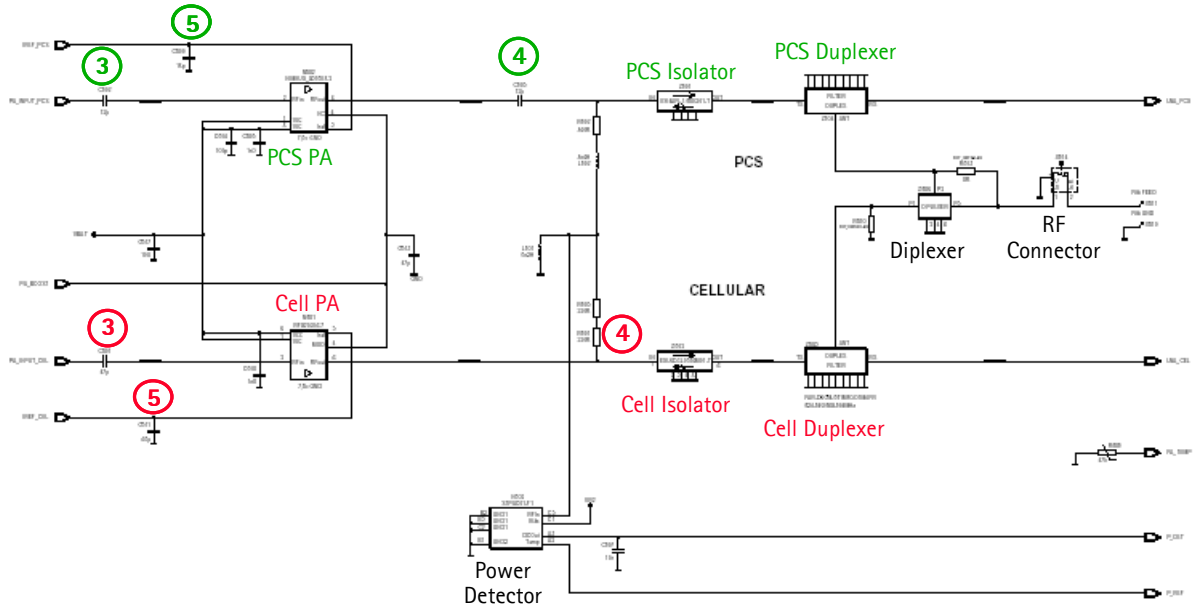

Figure 14: Transmitter Schematic 2

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TX Troubleshooting Using Phoenix

1. Use the **Phone Control** dialog box to turn the phone on.
2 Click the **Phone State** tab.
3. Highlight **Local**, and click the **Execute** button. This will put the phone into Local Mode.

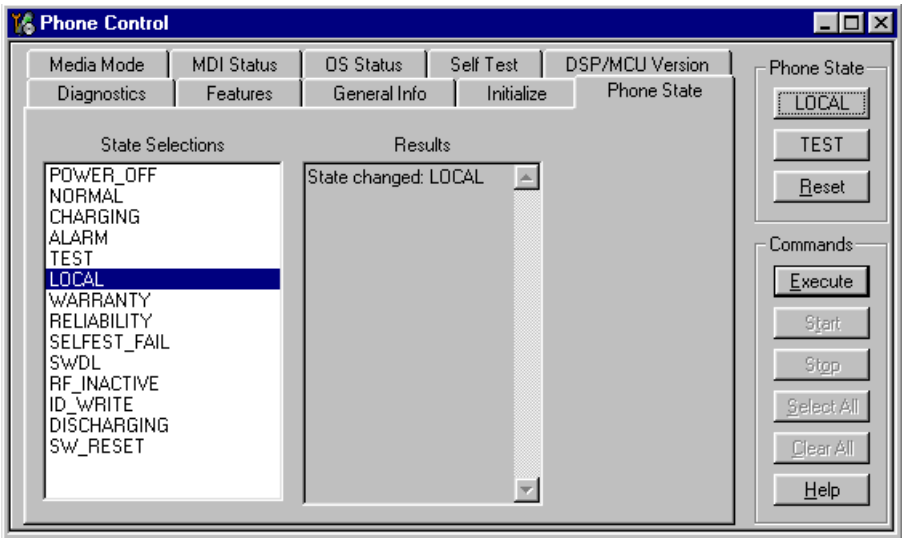

Figure 15: Phone Control dialog box

4. Use the **RF Main Mode** dialog box to set the following fields:
   - Band
   - Channel
   - Rx/Tx mode

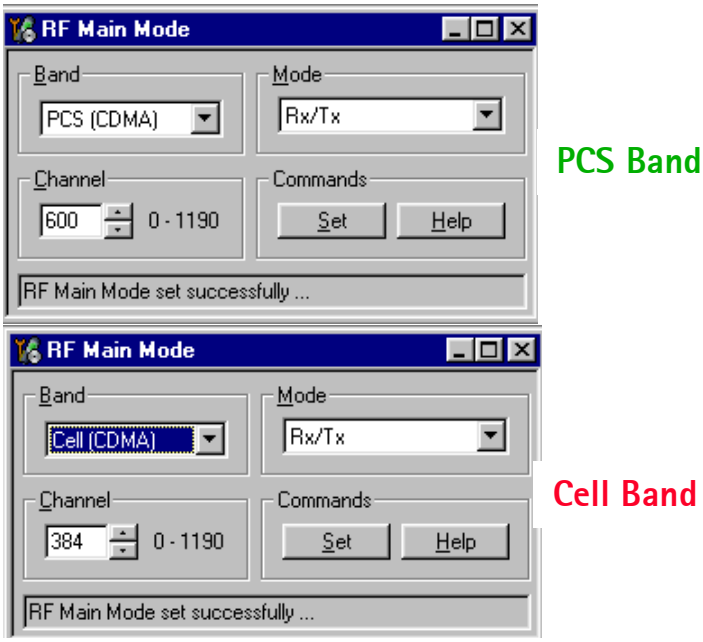

Figure 16: RF Main Mode dialog box with PCS and Cell band values

5. Click the **Set** button.

   Note: Make sure the "RF Main Mode set successfully..." message appears.

6. Open the **DSP** menu and select the **CDMA Control** option.
7. Select the **Rho ON** check box, and click the **Execute** button.

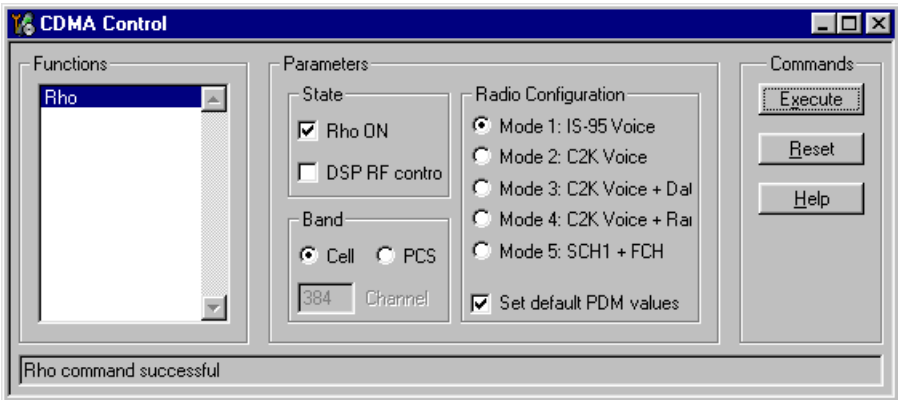

Figure 17: CDMA Control dialog box

8. At this point you should be able to measure TX Pout at the RF connector using the 8960 Call Box.
   - Cell Band TX Pout = +11dBm
   - PCS Band TX Pout = +12dBm

   If you do not see these powers, start probing the TX path to find out where the signal stops.

9. Adjust the PDM values using the **RF PDM** dialog box.

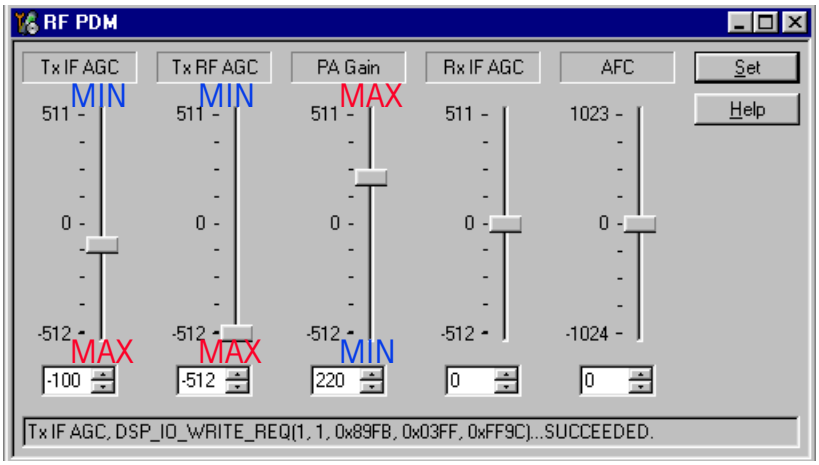

Figure 18: RF PDM dialog box

Note: If you do not measure the correct Tx power at the RF connector, then it is time to use the RF probe and determine where the failure occurs.

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10. Local Mode (either PCS channel 600 or Cell channel 384):

- PA Gain PDM = +220
- RF AGC PDM = -512
- IF AGC PDM = -105 (PCS), -135 (Cell)

With PDMs set to the above values:

- Phone TX Pout ≅ 23dBm (PCS)
  Current ≅ 720mA (PCS)
- Phone TX Pout ≅ 25dBm (Cell)
  Current ≅ 880mA (Cell)

PCS Band TX Probe Points

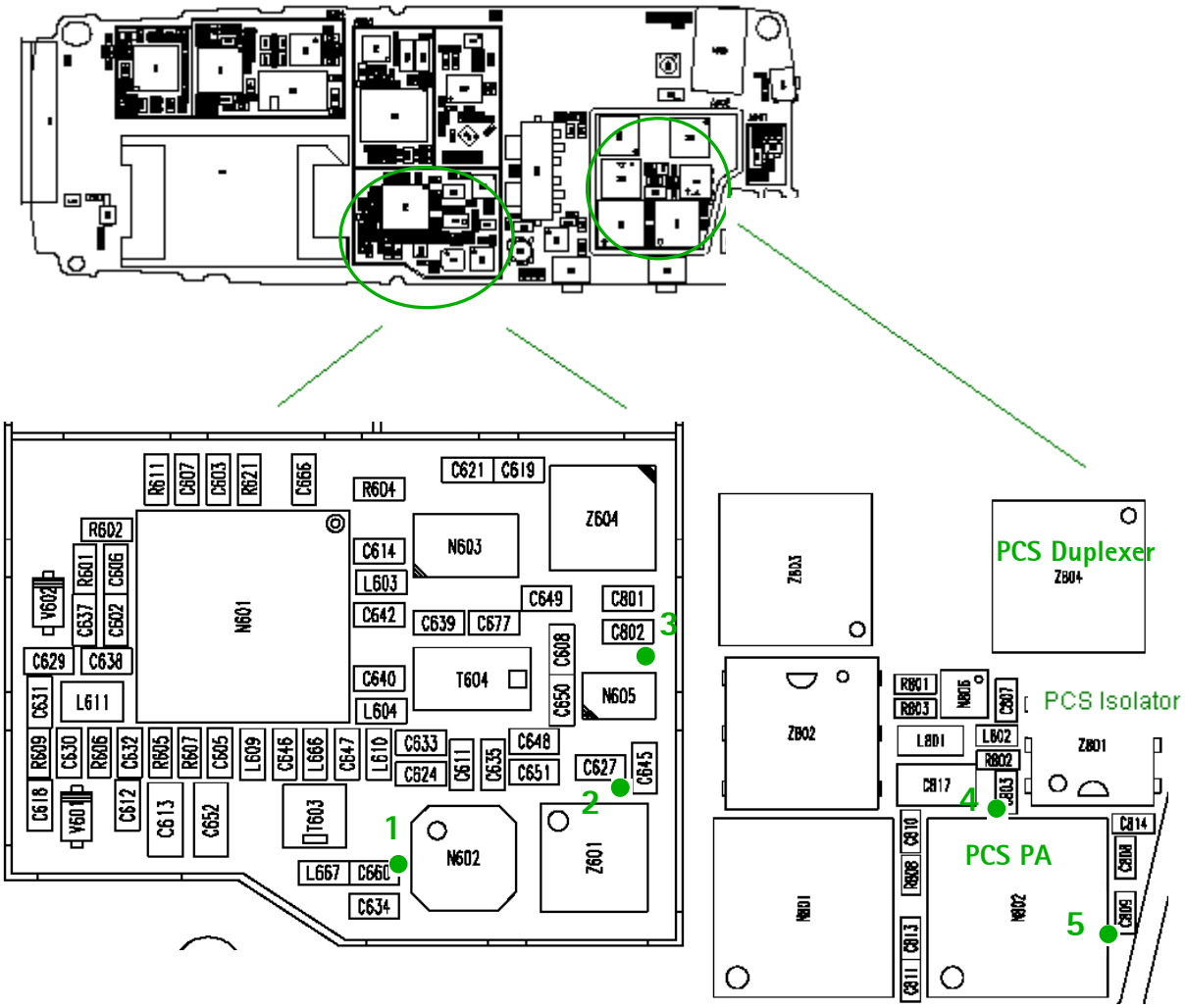

Figure 19: PCS band Tx probe points

Use the PDM settings from the previous section. Following are the approximate power levels you should expect for the PCS band (Channel 600):

- C660 Output of Robin (N601), input to Hornet (N602)
  Probed power ≅-2dBm (If not, then replace Robin)
- C627 Output of split-band filter (Z601)
  (Gain ≅10.5dB – (filter loss 2.3dB) ≅ 8.2dB)
  Probed power ≅ 7dBm (If not, then replace Hornet)
- C802 Output of the TX Switch (Loss ≅ 1dB)
  Probed power ≅ +6dBm (If not, then replace the switch)
- C803 Output of PCS PA (use 10dB pad on probe or just sniff part)
  Probed power ≅ +18dBm (If not, then replace the PCS PA)
- C809 IREF into PCS PA should be ≅ 2.7V (If not, trace back to Robin and then to the BB)

Cell and AMPS Band TX Probe Points

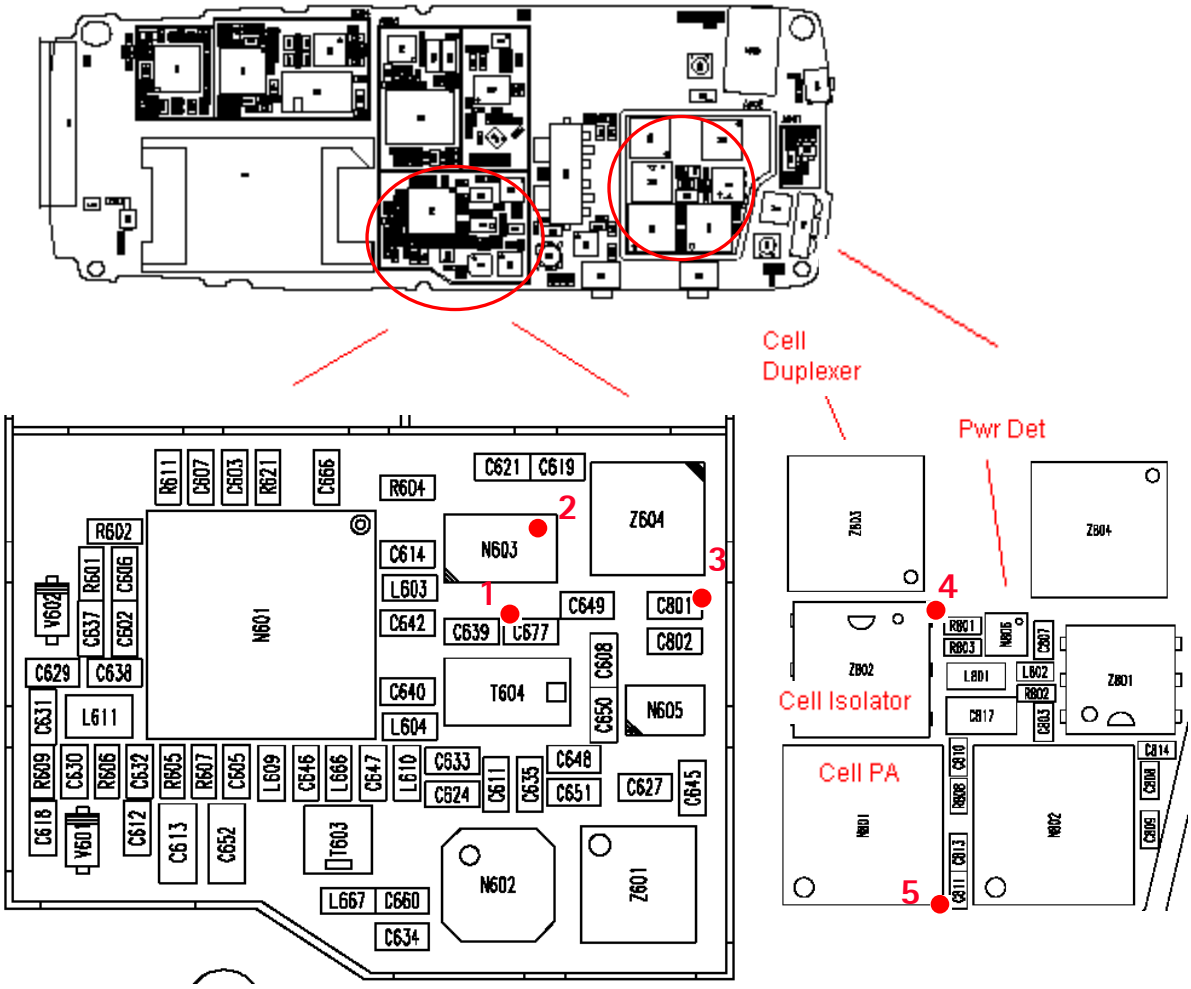

Figure 20: Cell and AMPS band TX probe points

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Use PDM settings from the previous section. Here are the approximate power levels you should expect for CELL BAND (Channel 384):

- C677 Output of Robin, Input to the Tomcat Driver
  Probed power ≅ -3dBm (If not, then replace Robin)
- Pin 6 of Tomcat Driver is the output (Gain ≅ 14dB)
  Probed power ≅ +11dBm (If not, then replace Tomcat)
- C80 Output of the TX Saw filter (Loss ≅ 1dB)
  Probed power ≅ +10dBm (If not, then replace the filter)
- R801 Output of Cell PA (use 10dB pad on probe or just sniff part)
  Probed power ≅ +21dBm (If not, then replace Cell PA)
- C811 IREF into Cell PA should be ≅ 2.7V (If not, then trace back to Robin and then to BB)

TX AMPS Troubleshooting Using Phoenix

Use the following steps to troubleshoot the TX AMPS using Phoenix:

1. In Local Mode/Main Mode, select AMPS Band.
2. Use PDM controls to adjust the PA, RF AND IF AGC.

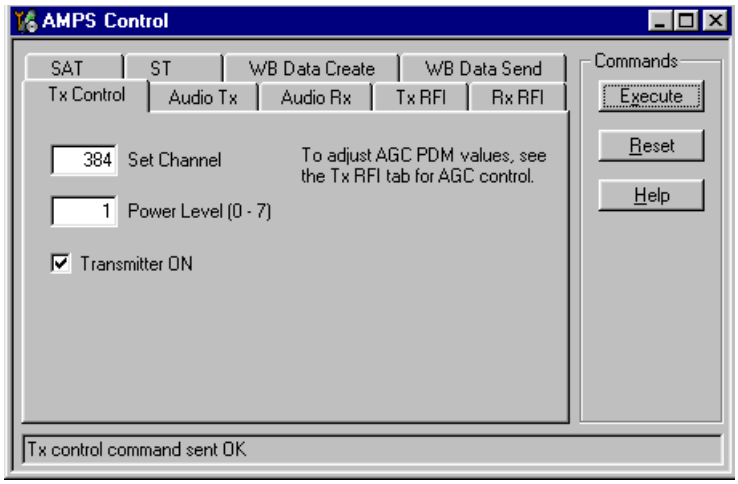

Figure 21: AMPS Control dialog box

3. Local Mode:
   - PA Gain PDM = 229
   - RF AGC PDM = -416
   - IF AGC PDM = -137

   With PDMs set to the above values:

   - Phone TX Pout ≅ +26dBm
     Current ≅ 998mA

   Note: If you do not measure the correct TX power at the RF connector, then repeat Cell band Local Mode troubleshooting to find where the failure occurs. AMPS and Cell band share the same TX path.

RX Troubleshooting

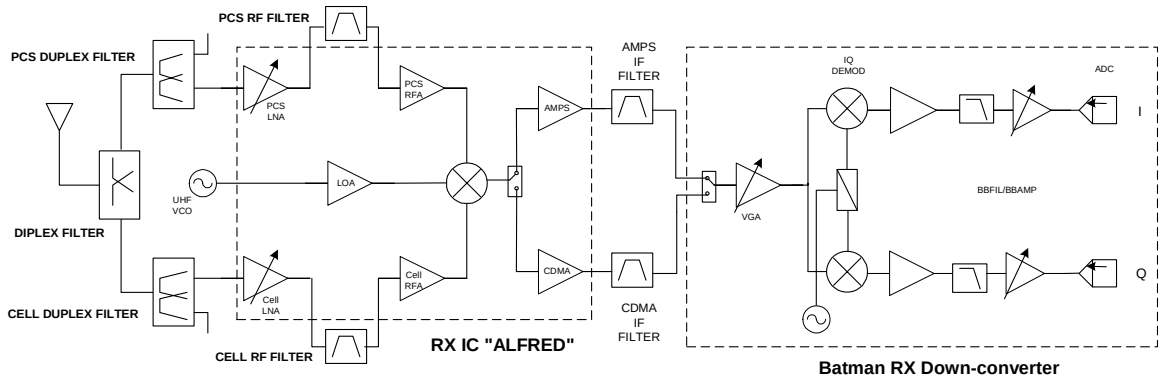

Figure 22: RM-11 RX system block diagram

Receiver Schematic

- An external signal source is injected to the RF input. The signal is then traced throughout the receiver chains.
- Agilent call box 8960 is recommended. Press the Call Setup button, then the Active Cell soft button, and then select CW.
- Inject a CW signal for PCS (1960MHz) or Cell/AMPS (881.52MHz) at a fixed 25dBm power level.

The numbers below indicate the general RF signal flow and probing locations. More details are shown in the following pages.

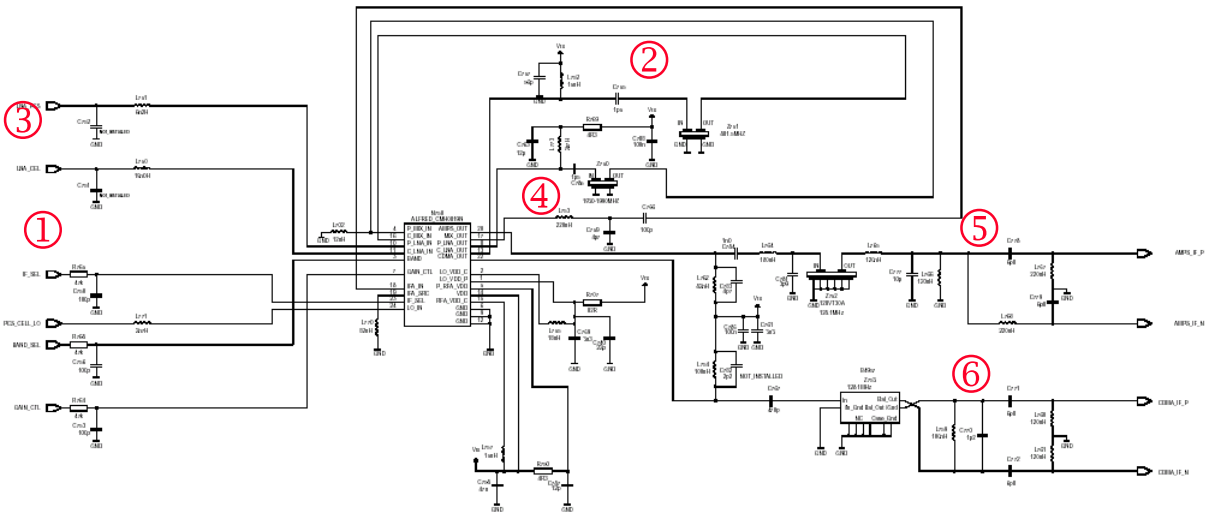

Figure 23: RF signal flow and probing locations

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Turning on Rx Path Using Phoenix

1. Turn on Receiver Only in CDMA Mode.
2. Set to RX mode, and set the band and channel to the following values:
   - PCS CH = 600, RX = 1960MHz
   - CELL CH = 384, RX = 881.52MHz
   - AMPS CH = 384, RX = 881.52MHz

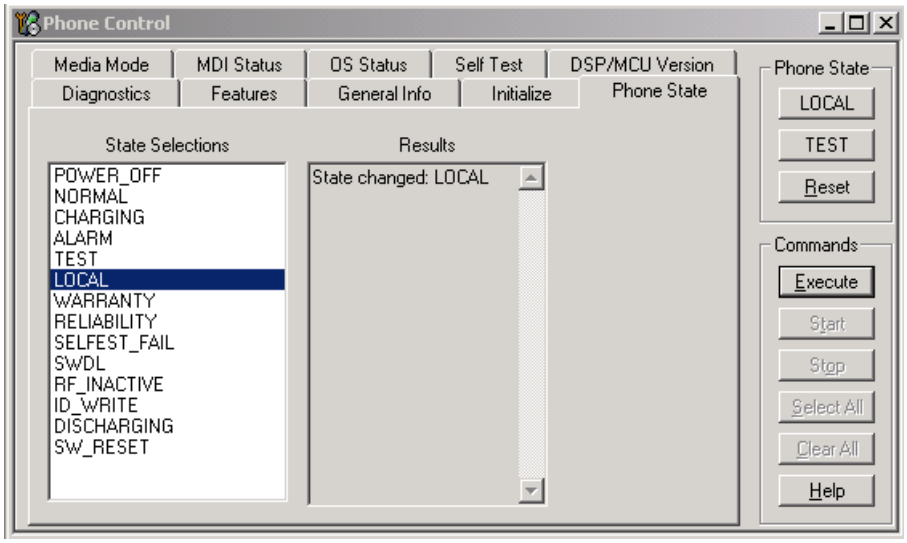

Figure 24: Phone Control dialog box

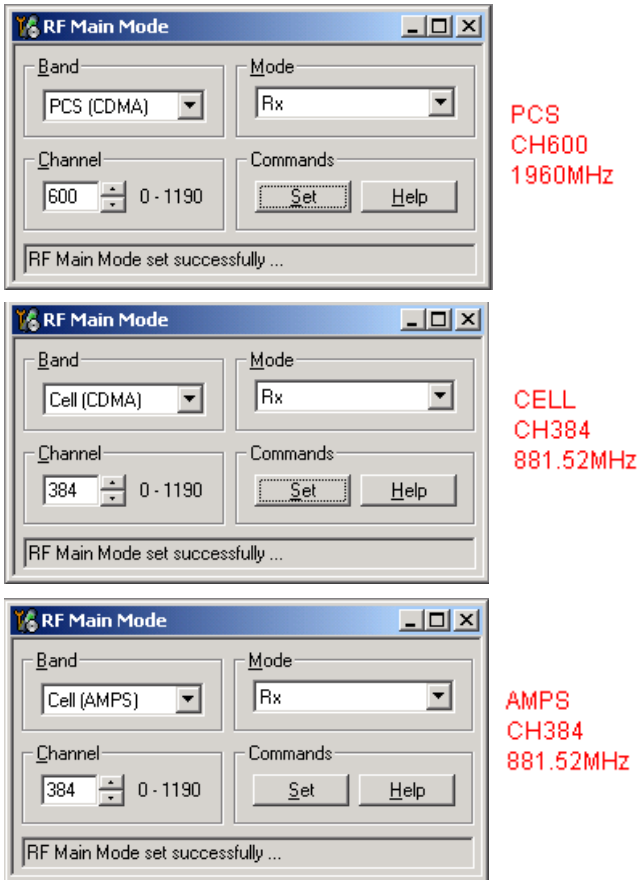

Figure 25: RF Main Mode dialog box for PCS, cell, and AMPS settings

Switching Rx Gain States Using Phoenix

Two gain states (Hi and Lo) are available in the receiver for CDMA and AMPS modes. Use the RF Gen I/O dialog box to change the gain state.

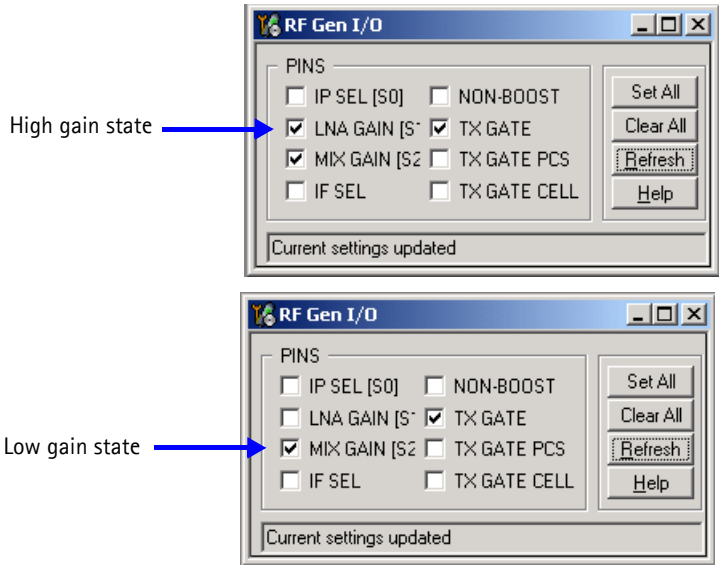

Figure 26: High and low gain states on the RF Gen I/O dialog box

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Receiver IF Troubleshooting Layout

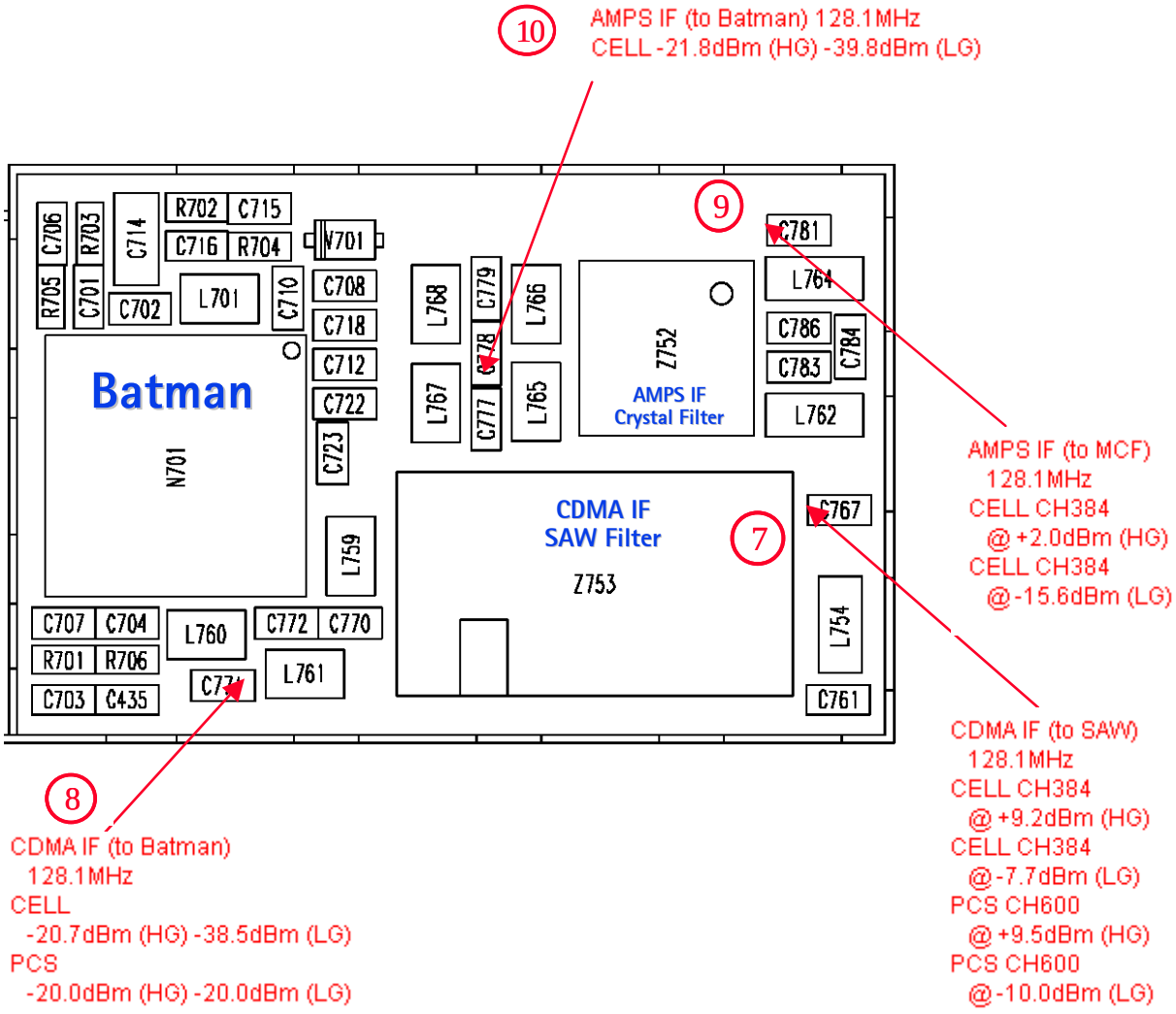

Figure 27: Receiver IF troubleshooting layout

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Receiver RF Troubleshooting Layout

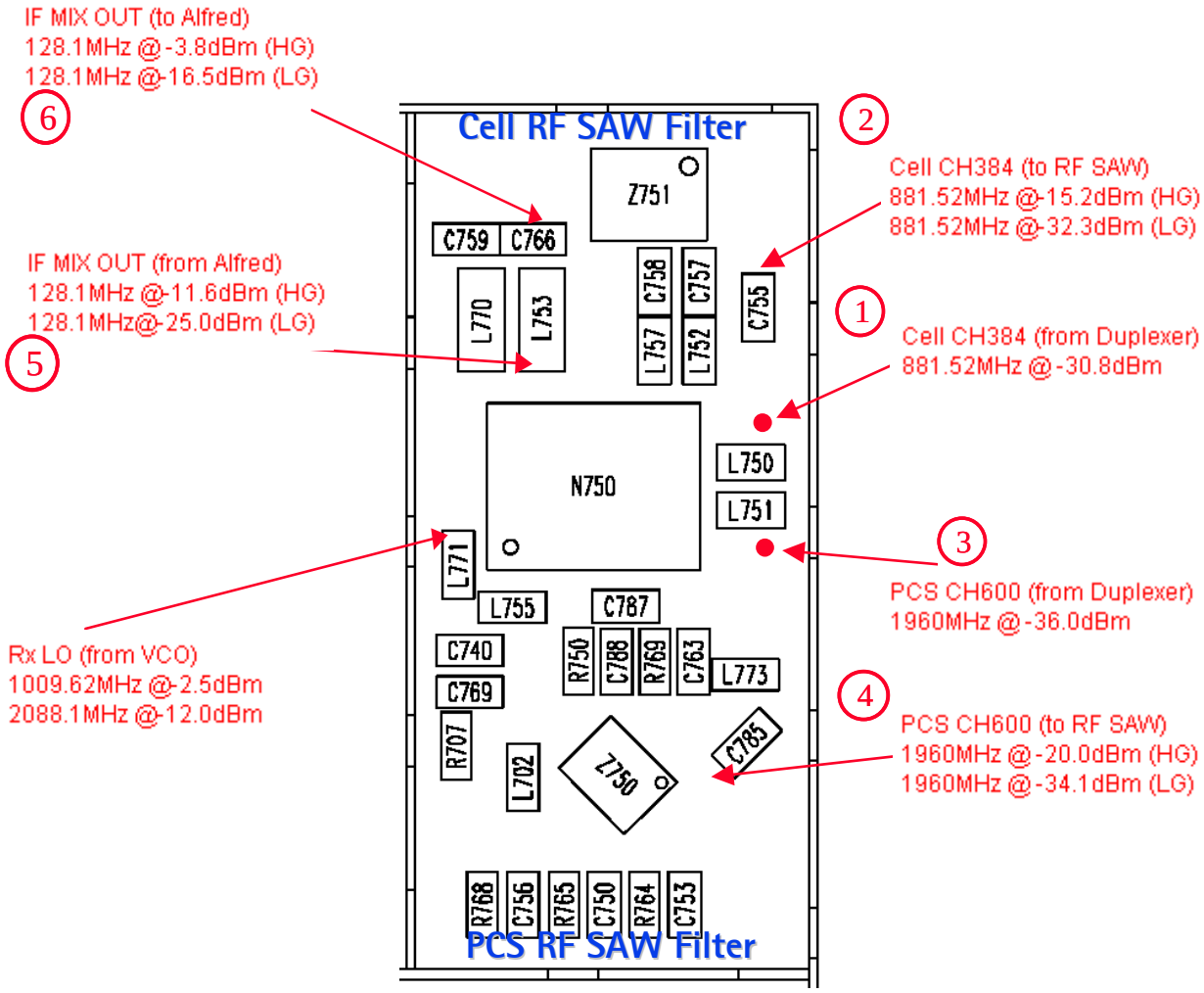

Figure 28: Receiver RF troubleshooting layout

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Receiver DC Troubleshooting Layout

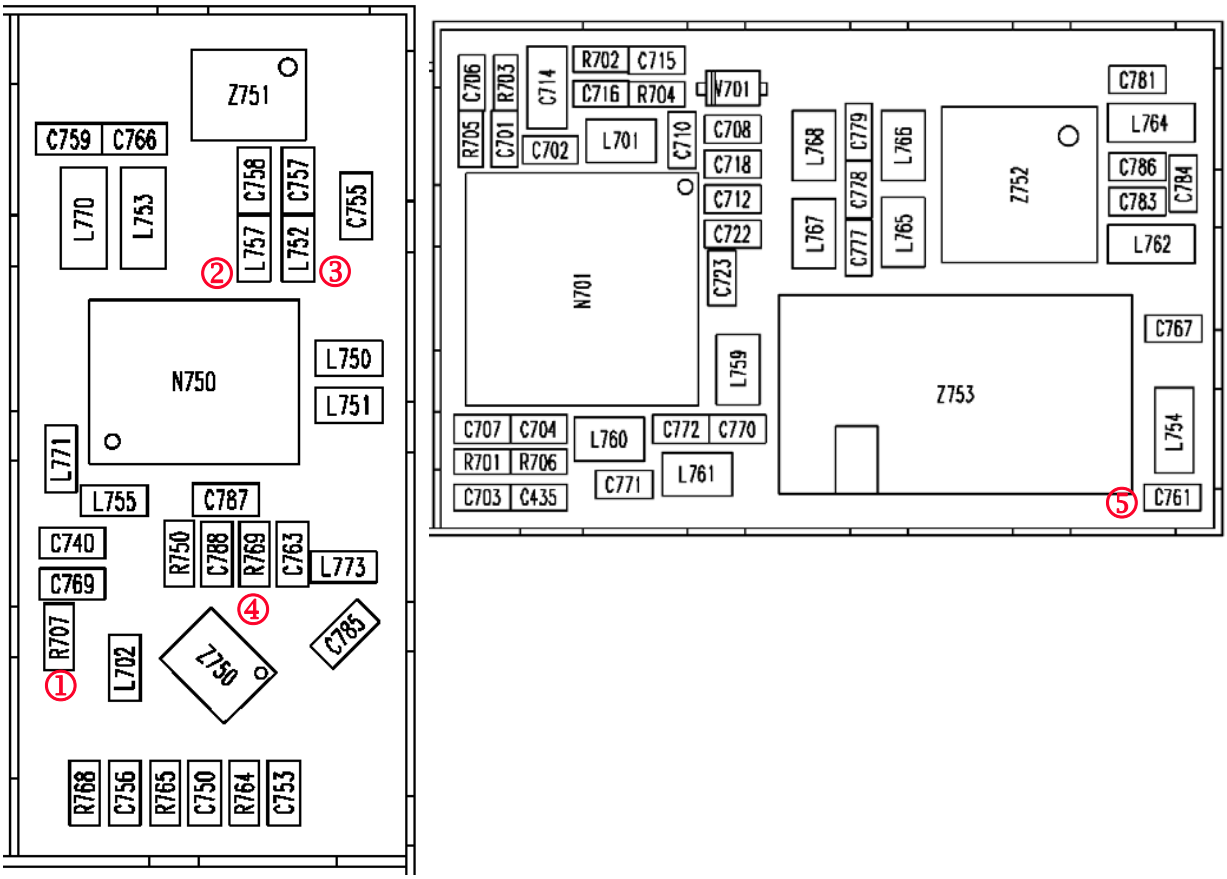

Figure 29: Receiver DC troubleshooting layout

1. LO Vdd = 2.779 VDC LOA Vdd supply lines for cell and PCS
2. RFA Vdd = 2.799 VDC RFA Vdd supply line for cell band
3. C_LNA Vdd = 2.779 VDC External Vdd supply line for Cell LNA
4. P_LNA Vdd = 2.779 VDC External Vdd supply line for PCS LNA
5. IFA Vdd = 2.779 VDC IFA Vdd supply line for CDMA and AMPS IFs

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Receiver DC Troubleshooting Layout

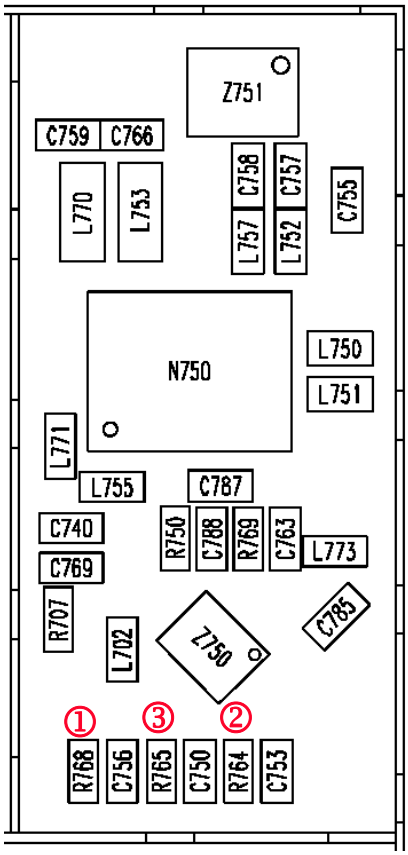

Figure 30: Receiver DC troubleshooting layout

Table 1 includes the measure logic levels for the Rx front end.

Table 1: Measure Logic Levels for Rx Front End (N750)

	Logic Inputs Voltages		
Modes	**Band (1)**	**Gain_CTU (2)**	**IF_SEU (3)**
CELL CDMA HI-GAIN	0.1 V	2.75 V	0 V
CELL CDMA LOW-GAIN	0.1 V	0 V	0 V
PCS CDMA HI-GAIN	2.68 V	2.75 V	0 V
PCS CDMA LOW-GAIN	2.68 V	0 V	0 V
AMPS HI-GAIN	0.1 V	2.76 V	2.76 V
AMPS LOW-GAIN	0.1 V	0 V	2.76 V

Note: If logic levels are significantly off (+/- 0.2V), replace Alfred (N750) and re-measure. If voltages are still out-of-spec, consult Troubleshooting - Baseband section of this manual.

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Alfred Receiver Troubleshooting

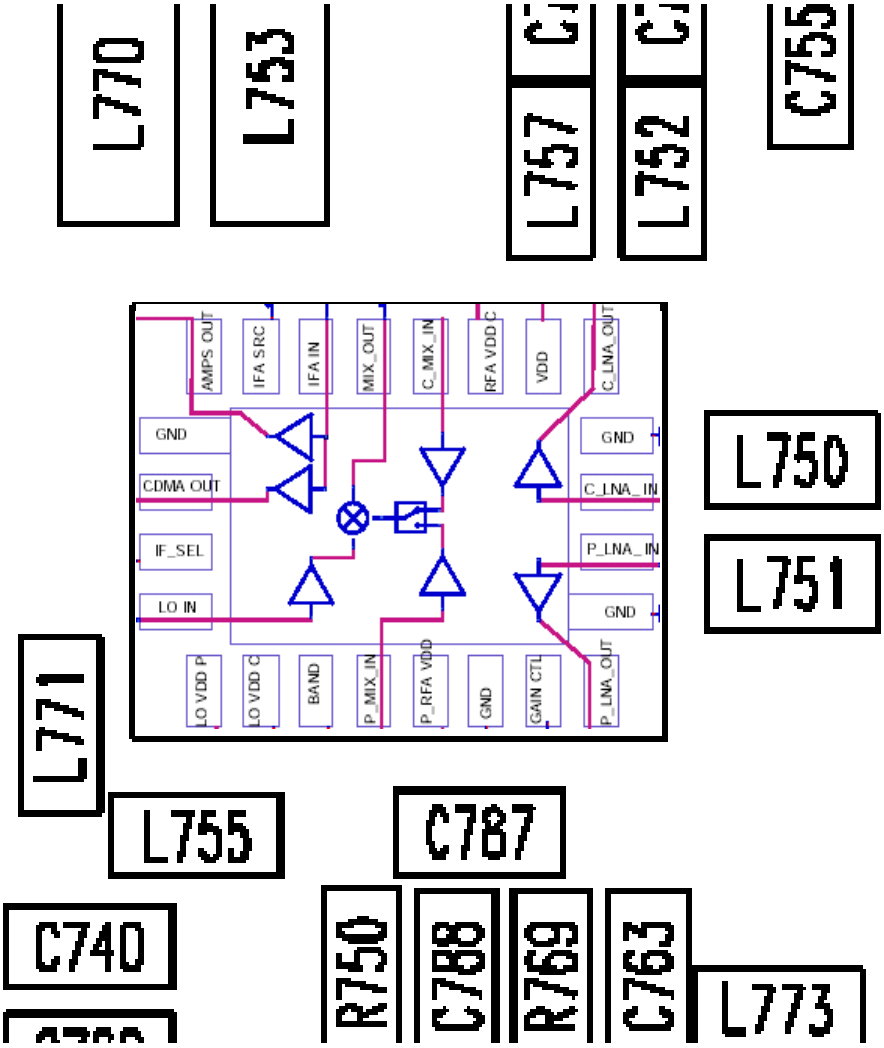

Figure 31: Alfred receiver troubleshooting layout

Things to keep in mind:

- There is a separate LNA for 800MHz (Cell and AMPS) and 1900MHz (PCS).
- Inside Alfred is the RFA again. There is a separate RFA for 800MHz (Cell and AMPS) and 1900MHz (PCS).
- After RFA, there is a mixer and then the signals are separated by CDM (Cell and PCS) and AMPS.

  For example, if there is no IF frequency (128.1MHz), check both Cell and PCS. If only one has at 128.1MHz (L753), check IF_Sel is working. If it is, then replace Alfred (bad RFA).

- If Cell and AMPS are working fine, but PCS is not, look at the band select line and the PCS LNA before replacing Alfred.

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Receiver DC Troubleshooting Alfred

Eventually, you will run into an Alfred failure that has the symptoms of high current in local mode with just the Rx turned on. There can be two common explanations for this: (1) No presence of an LO signal, and (2) input impedance drop shorting out one of the DC supply pins to the chip. IMPORTANT: YOU MUST CHECK FOR BOTH CONDITIONS BEFORE REPLACING THE CHIP. If you have no LO signal, refer to the section of this chapter on troubleshooting the UHF LO. If you have a significant supply voltage drop on one of the supply pins, then change Alfred.

Table 2: Conditions and supply current values

Condition (Local Mode, Set Rx only in RF Main Mode)	Supply Current (from power supply)
Good phone	104mA
No UHF LO Signal present	254mA
Pin 13 shorted	255mA

Control Signals at RF-BB Interface

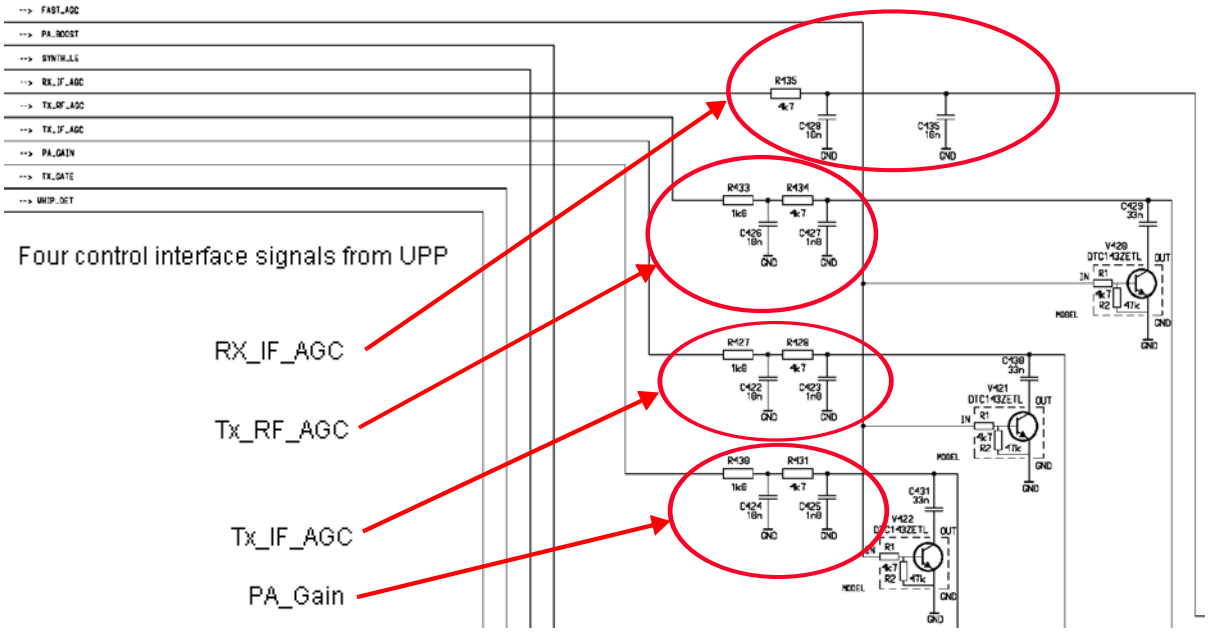

Figure 32: Control signals at RF-BB interface

Note: These components are located at the back panel. Check from SMD or missing components.

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Back Panel Control Signals RF-BB Interface

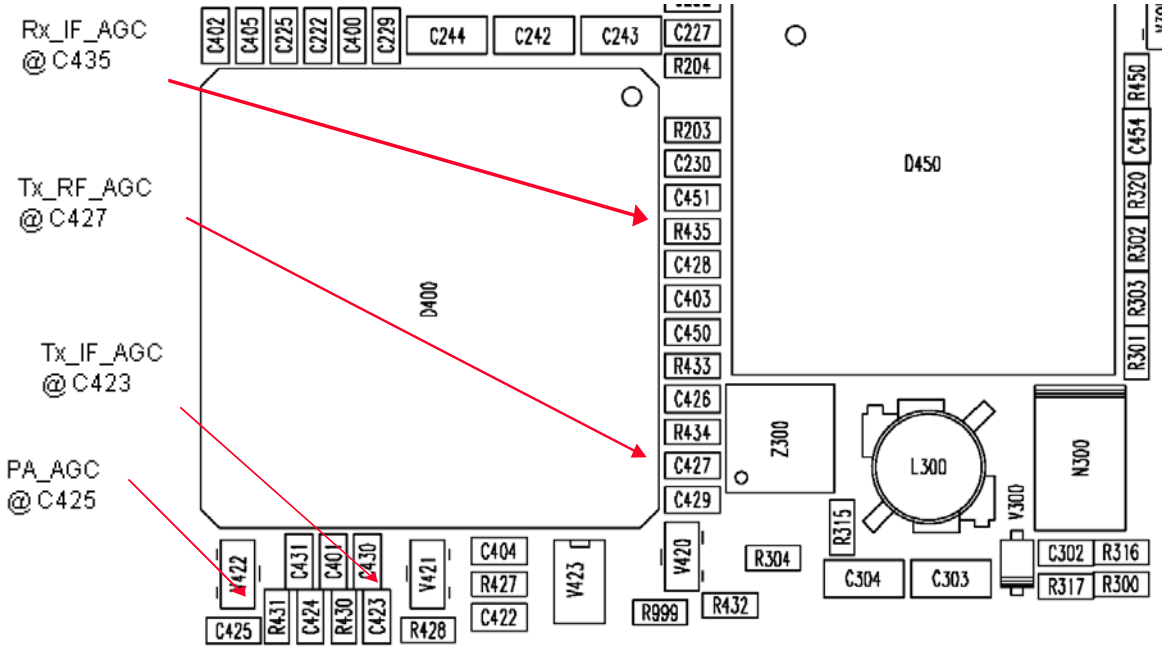

Figure 33: Back panel control signals RF-BB interface

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